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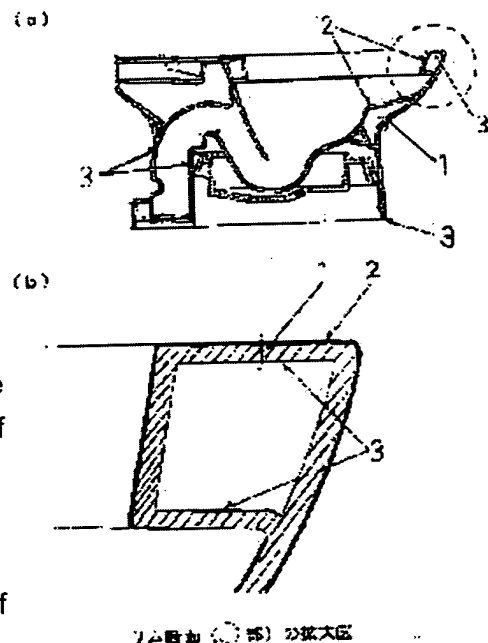
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## (54) CERAMIC PRODUCT IN CONTACT WITH WATER AND ITS MANUFACTURING METHOD

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a ceramic product in contact with water free of penetration with time due to hydration swelling, freezing damage and sanitary problem such as pollution and excellent in dimensional precision of the product without any modifications, etc., in the manufacturing stage.

**SOLUTION:** This ceramic product in contact with water consists of a green body and a glaze layer formed on the necessary part on the green body, and the central part of the green body is formed with a water-absorptive ceramic green body. The water absorptivity of the part on the surface of the green body on which at least the glaze layer is not formed and in contact with the inside of a water passage and water is made lower than the center part of the green body.



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CLAIMS

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[Claim(s)]

[Claim 1] The portion which is the place-equipped-with-a-water-supply product made from pottery which consists of a cover coat layer formed in a base and the required portion on it, and is the portion in which the center section of the aforementioned base becomes from the earthenware simple ground with absorptivity, and the cover coat layer is not formed at least among the surface sections of the aforementioned base, and contacts the interior of a headrace and water is the place-equipped-with-a-water-supply product made from pottery characterized by for absorptivity to be small than the center section of the aforementioned base.

[Claim 2] The portion which is the place-equipped-with-a-water-supply product made from pottery which consists of a cover coat layer formed in a base and the required portion on it, the center section of the aforementioned base has an ink penetrance larger than 3mm, is a portion in which the cover coat layer is not formed at least among the surface sections of the aforementioned base, and contacts the interior of a headrace and water is a place-equipped-with-a-water-supply product made from pottery characterized by an ink penetrance being 3mm or less.

[Claim 3] Composition of the principal component which constitutes the aforementioned base 2:45 - 70 % of the weight of SiO(s), It is 2O3:25 - 50 % of the weight of aluminum, and the total amount of at least one sort of alkali-metal oxides chosen from the group which consists of Na<sub>2</sub>O, K<sub>2</sub>O, and Li<sub>2</sub>O is 2 or less % of the weight. At least one sort of alkali-metal oxides chosen from the group which consists of Na<sub>2</sub>O, K<sub>2</sub>O, and Li<sub>2</sub>O, and CaO, the claims 1 and 2 characterized by the total amount of at least one sort of alkaline-earth-metal oxides chosen from the group which consists of MgO, BaO, and BeO being 6 or less % of the weight -- the place-equipped-with-a-water-supply product made from pottery given in either

[Claim 4] The place-equipped-with-a-water-supply product made from pottery according to claim 3 further characterized by a quartz, a cristobalite, a mullite, and at least one sort of minerals chosen from the group which consists of corundum containing as a crystal at the aforementioned base.

[Claim 5] The place-equipped-with-a-water-supply product made from pottery given in the claims 3 and 4 characterized by the amount of contraction of the longitudinal direction of the test piece when producing a test piece with width of face of 25mm, a thickness [ of 5mm ], and a length of 230mm being 7% or less using the same base and same cover coat as the aforementioned place-equipped-with-a-water-supply product made from pottery.

[Claim 6] A  $\phi$ 14x130mm test piece is produced using the same base and same cover coat as the aforementioned place-equipped-with-a-water-supply product made from pottery. The flexural strength computed when a three-point bending test is carried out on condition that span 100mm and crosshead speed 2.5 mm/min by the autograph using the test piece is 30 or more MPas. The same base and same cover coat as the aforementioned place-equipped-with-a-water-supply product made from pottery are used. And width of face of 25mm, Produce a test piece with a thickness [ of 5mm ], and a length of 230mm, and the test piece is supported by two span 200mm points. The place-equipped-with-a-water-supply product made from pottery given in the claims 3 and 4 which carry out a temperature up to 1000

degrees C in 4 hours, carry out a temperature up to 1200 more degrees C in 2 hours, and are characterized by the amount of deflections of the test piece when cooling naturally to a room temperature being 5mm or less after holding at 1200 degrees C for 1 hour.

[Claim 7] The claim 3, the place-equipped-with-a-water-supply product made from pottery of four publications which are characterized by the line coefficient of thermal expansion of the longitudinal direction of the test piece when producing a test piece being less than  $[90 \times 10^{-7} / \text{degree C}]$  using the same base and same cover coat as the aforementioned place-equipped-with-a-water-supply product made from pottery.

[Claim 8] The aforementioned place-equipped-with-a-water-supply product made from pottery is a place-equipped-with-a-water-supply product made from pottery according to claim 1 to 7 characterized by being a lavatory, a urinal, a closet, a baby bus, a washhand basin, or a toilet bowl tank.

[Claim 9] The manufacture method of the place-equipped-with-a-water-supply product made from pottery according to claim 1 to 8 characterized by providing the following. The base manufacture process which produces a base raw material by performing grain refining of the ceramic industry raw material which makes a principal component  $\text{SiO}_2$  and aluminum  $2\text{O}_3$ . The process which performs water absorption prevention processing to the surface section which is the portion in which the cover coat layer is not formed, and may contact the interior of a headrace, and water after performing the forming cycle which forms a forming base, the dryness process which dries the aforementioned forming base, the glazing process which applies a cover coat on the aforementioned forming base, and a baking process.

[Claim 10] The manufacture method of the place-equipped-with-a-water-supply product made from pottery according to claim 9 characterized by being the process to which the process which performs the aforementioned water absorption prevention processing applies the permeability water absorption inhibitor of a silane system, a siloxane system, and a silica system.

[Claim 11] The manufacture method of the place-equipped-with-a-water-supply product made from pottery according to claim 9 or 10 characterized by the method of application of the water absorption inhibitor in the process which performs the aforementioned water absorption prevention processing being a dipping method.

[Claim 12] The manufacture method of the place-equipped-with-a-water-supply product made from pottery according to claim 9 to 10 characterized by being the atomization method with which the method of application of the water absorption inhibitor in the process which performs the aforementioned water absorption prevention processing is represented by the air-spray method.

[Claim 13] It is the manufacture method of the place-equipped-with-a-water-supply product made from pottery according to claim 9 to 12 which the place-equipped-with-a-water-supply product made from pottery which applies the aforementioned water absorption prevention processing is a closet, and is characterized by the aforementioned predetermined surface section being a part which contacts at a wall and a floor line at the time of the interior of a headrace represented by the interior of a trap, or the rim, and/or closet installation.

[Claim 14] It is the manufacture method of the place-equipped-with-a-water-supply product made from pottery according to claim 9 to 12 which the place-equipped-with-a-water-supply product made from pottery which applies the aforementioned water absorption prevention processing is a lavatory, and is characterized by the aforementioned predetermined surface section being the interior of overflow.

[Claim 15] It is the manufacture method of the place-equipped-with-a-water-supply product made from pottery according to claim 9 to 12 which the place-equipped-with-a-water-supply product made from pottery which applies the aforementioned water absorption prevention processing is a urinal, and is characterized by the aforementioned predetermined surface section being a part which contacts a wall and a floor line at the time of the interior of a trap or a headrace, and/or urinal installation.

[Claim 16] It is the manufacture method of the place-equipped-with-a-water-supply product made from pottery according to claim 9 to 12 which the pottery which applies the aforementioned water absorption prevention processing is a toilet bowl tank, and is characterized by the aforementioned predetermined surface sections being the interior of a toilet bowl tank, and/or the tank base unglazed section.

[Claim 17] The aforementioned base raw material is the manufacture method of the place-equipped-with-a-water-supply product made from pottery according to claim 9 characterized by the mean particle diameter measured with a laser diffraction formula particle-size-analysis vessel being 1-20 micrometers.

[Claim 18] The manufacture method of the place-equipped-with-a-water-supply product made from pottery according to claim 9 characterized by the forming method in the aforementioned forming cycle being slurry casting.

[Claim 19] The burning temperature in the aforementioned baking process is the manufacture method of the place-equipped-with-a-water-supply product made from pottery according to claim 9 characterized by being 1100-1300 degrees C.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the place-equipped-with-a-water-supply product made from pottery represented by sanitary wares, such as a closet, a urinal, and a lavatory, and its manufacture method.

[0002]

[Description of the Prior Art] The base has exposed the pottery product, without forming the cover coat layer only in the required portion of the pottery simple ground, for example, generally, forming a cover coat layer in a closet headrace and the floor installation section of a toilet bowl.

[0003] Therefore, since earthenware generally has water absorption when a base is formed qualitatively of earthenware, water may permeate a base through the above-mentioned base outcrop, and problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion, may arise. Then, conventionally, by making it \*\*\*\*\*-ize, made the glass phase generate, and the glass phase filled the crevice between the particles in a base, the whole base was made to turn precisely, and the device which abolishes absorptivity has been made.

[0004]

[Problem(s) to be Solved by the Invention] However, passing through such a sintering process made big burning shrinkage and deformation of a base produce, and it had become the cause of worsening the precision of a product size. Namely, although the so-called rate credit of deducing the raw size configuration where the deformation accompanying the amount of burning shrinkage or contraction was taken into consideration was performed in order to obtain the product size made into an aim, since burning shrinkage was large, the variation by the firing environments etc. was also large and needed the correction by grinding etc. depending on the case. this invention is for it to be made in view of the above-mentioned situation, and for a problem not produce the purpose in sanitation sides, such as delayed crazing by the moisture expansion, a frost damage, and contamination, not make correction at the time of manufacture, but suppose that offer of the place-equipped-with-a-water-supply product made from pottery with a good precision of a product size is possible also for \*\*.

[0005]

[Means for Solving the Problem] It is the place-equipped-with-a-water-supply product made from pottery which consists of a cover coat layer formed in a base and the required portion on it in this invention that the above-mentioned technical problem should be solved. It is the portion in which the center section of the aforementioned base becomes from the earthenware simple ground with absorptivity, and the cover coat layer is not formed at least among the surface sections of the aforementioned base. And the portion which may contact the interior of a headrace and water offers the place-equipped-with-a-water-supply product made from pottery characterized by absorptivity being smaller than the center section of the aforementioned base. It is the portion in which the contraction and deformation at the time of baking can be suppressed as much as possible, it can produce, and the cover coat layer is not formed at least among the surface sections of a base by doing so since the center section

of the base is an earthenware simple ground with absorptivity. And since absorptivity is smaller than the center section of the aforementioned base, the water absorption in a base outcrop is suppressed and problems, such as a frost damage in delayed crazing or the cold district by the moisture expansion, cannot produce easily the portion which may contact the interior of a headrace, and water.

[0006] It is the place-equipped-with-a-water-supply product made from pottery which consists of a cover coat layer formed in a base and the required portion on it, and the center section of the aforementioned base has an ink penetrance larger than 3mm, and it is the portion in which the cover coat layer is not formed at least among the surface sections of the aforementioned base, and is made for the ink penetrance of the portion which may contact the interior of a headrace and water to be 3mm or less in the desirable mode of this invention. By doing so, since the center section of the base is the earthenware simple ground where an ink penetrance has absorptivity by 3mm or more and porosity in the portion in which the contraction and deformation at the time of baking can be suppressed as much as possible, it can produce, and the cover coat layer is not formed at least among the surface sections of a base. And since an ink penetrance is 3mm or less, the water absorption from a base outcrop is suppressed and problems, such as a frost damage in delayed crazing or the cold district by the moisture expansion, cannot produce easily the portion which may contact the interior of a headrace, and water.

[0007] Composition of the principal component which constitutes a base in the desirable mode of this invention. They are 2:45 - 70 % of the weight of  $\text{SiO}_2$ , and 20:25 - 50 % of the weight of aluminum. The total amount of at least one sort of alkali-metal oxides chosen from the group which consists of  $\text{Na}_2\text{O}$ ,  $\text{K}_2\text{O}$ , and  $\text{Li}_2\text{O}$  is 2 or less % of the weight. It is made for the total amount of at least one sort of alkaline-earth-metal oxides chosen from the group which serves as at least one sort of alkali-metal oxides chosen from the group which consists of  $\text{Na}_2\text{O}$ ,  $\text{K}_2\text{O}$ , and  $\text{Li}_2\text{O}$  from  $\text{CaO}$ ,  $\text{MgO}$ ,  $\text{BaO}$ , and  $\text{BeO}$  to be 6 or less % of the weight. By stopping low the composition ratio of the alkali metal and alkaline earth metal which act as a sintering acid, generation of the glass phase by sintering and sintering is suppressed, and the deformation accompanying burning shrinkage or it becomes small.

[0008] It is made for a quartz, a cristobalite, a mullite, and at least one sort of minerals chosen from the group which consists of corundum to contain as a crystal further on the aforementioned base in the desirable mode of this invention. The intensity of a base improves by doing so.

[0009] It is made for the amount of contraction of the longitudinal direction of the test piece when producing a test piece with width of face of 25mm, a thickness [ of 5mm ], and a length of 230mm using the same base and same cover coat as the aforementioned place-equipped-with-a-water-supply product made from pottery to be 7% or less in the desirable mode of this invention. By doing so, burning shrinkage is small and the product by which the dimensional accuracy was stabilized can be obtained.

[0010] In the desirable mode of this invention, the same base and same cover coat as the aforementioned place-equipped-with-a-water-supply product made from pottery are used. A  $\phi 14 \times 130\text{mm}$  test piece is produced and the test piece is used. by the autograph Span 100mm, The flexural strength computed when a three-point bending test is carried out on condition that crosshead speed 2.5 mm/min is 30 or more MPas. The same base and same cover coat as the aforementioned pottery are used. And width of face of 25mm, thickness of 5mm, Produce a test piece with a length of 230mm and the test piece is supported by two span 200mm points. After carrying out a temperature up to 1000 degrees C in 4 hours, carrying out a temperature up to 1200 more degrees C in 2 hours and holding at 1200 degrees C for 1 hour, it is made for the amount of deflections of the test piece when cooling naturally to a room temperature to be 5mm or less. By doing so, it has intensity usually usable as a product, and baking deformation is small and can obtain the product by which the dimensional accuracy was stabilized.

[0011] It is made for the line coefficient of thermal expansion of the longitudinal direction of the test piece when producing a test piece using the still more nearly same base and cover coat as the aforementioned make place-equipped-with-a-water-supply product pottery to be less than [  $90 \times 10^{-7}/\text{degree C}$  ] in the desirable mode of this invention. Matching with the cover coat currently generally used for the pottery product is good, and it is hard coming to generate fault generating of cover coat sides, such as a glaze jump and intrusion, by doing so. Moreover, the base piece in the cooling process at the time of the baking process of the base itself is suppressed, and a thermal shock resistance improves

further.

[0012] In the 1 manufacture method of the place-equipped-with-a-water-supply product made from pottery of this invention The base manufacture process which produces a base raw material by performing grain refining of the ceramic industry raw material which makes a principal component  $\text{SiO}_2$  and aluminum  $2\text{O}_3$ , After performing the forming cycle which forms a forming base, the dryness process which dries the aforementioned forming base, the glazing process which applies a cover coat on the aforementioned forming base, and a baking process, in the portion in which the cover coat layer is not formed And it is made to perform the process which performs water absorption prevention processing to the surface section which may contact the interior of a headrace, and water. By doing so, osmosis of the water from the surface section which may contact the interior of a headrace and water can be prevented, and it is hard to produce problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion.

[0013] In the process which performs the aforementioned water absorption prevention processing, the same water absorption prevention effect can be acquired by applying coating agents, such as organic and an inorganic water absorption inhibitor, a sealer, and a primer, a filler, etc. to common paint rows, such as the oil paint by which Kamiichi is carried out, lacquer, alkyd resin coating, vinyl resin coating, acrylic resin coating, epoxy resin coating, polyurethane resin enamels and varnishes, a polyester resin paint, and silicone coating. It is made to be the process to which the process which performs the aforementioned water absorption prevention processing in the more desirable mode of this invention furthermore applies the permeability water absorption inhibitor of a silane system, a siloxane system, and a silica system. By doing so, by the silane system and the siloxane system permeability water absorption inhibitor, since a water absorption prevention layer powerful from the surface section to several mm range is generated when a permeability water absorption inhibitor permeates into a base and combines with the silanol group in a base chemically, it can be rich in endurance and the prolonged water absorption prevention effect can be acquired. Moreover, in a silica system permeability water absorption inhibitor, a silica particle enters into the pore in a base, and can acquire the water absorption prevention effect semipermanently restoration and by carrying out closed \*\* for the pore itself. Therefore, it is hard to produce problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion.

[0014] the method of application of the water absorption inhibitor in the process which performs the aforementioned water absorption prevention processing -- setting -- brush coating, roller brush coating, and a trowel -- the general methods of application, such as coating, are applicable It is made for the process which furthermore performs the aforementioned water absorption prevention processing in the more desirable mode of this invention to be a dipping method. It can apply also to a portion like the interior of the interior of a headrace and overflow of a lavatory represented with doing so by the interior of a trap or the rim of a closet and a urinal, and a toilet bowl tank which is hard to apply easily.

[0015] It is made for the method of application of the water absorption inhibitor in the process which furthermore performs the aforementioned water absorption prevention processing to be the atomization method represented by the air-spray method. By doing so, the atomization of a water absorption inhibitor is made and it can apply also to a portion like the interior of the interior of a headrace and overflow of a lavatory represented by the interior of a trap or the rim of a closet and a urinal, and a toilet bowl tank which is hard to apply easily.

[0016] The place-equipped-with-a-water-supply product made from pottery which applies the aforementioned water absorption inhibitor is a closet, and it is made for the aforementioned predetermined surface sections to be the interior of a headrace represented by the interior of a trap, or the rim, and/or a part which contacts a wall and a floor line at the time of closet installation. A headrace shows the part which a wash water lets flow like the ZETT hole in the case of washing not only with a rim but with a closet. To the part which may contact the water in a closet by doing so, water absorption prevention processing will be performed and it is hard to produce problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion.

[0017] The place-equipped-with-a-water-supply product made from pottery which applies the



aforementioned water absorption inhibitor is a lavatory, and it is made for the aforementioned predetermined surface section to be the interior of overflow. To the part which may contact the water in a lavatory by doing so, water absorption prevention processing will be performed and it is hard to produce problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion.

[0018] The pottery which applies the aforementioned water absorption inhibitor is a urinal, and it is made for the aforementioned predetermined surface sections to be the interior of a trap or a headrace, and/or a part which contacts a wall and a floor line at the time of urinal installation. To the part which may contact the water in a urinal by doing so, water absorption prevention processing will be performed and it is hard to produce problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion.

[0019] The pottery which applies the aforementioned water absorption inhibitor is a toilet bowl tank, and it is made for the aforementioned predetermined surface sections to be the interior of a toilet bowl tank, and/or the tank base unglazed section. To the part which may contact the water in a toilet bowl tank by doing so, water absorption prevention processing will be performed and it is hard to produce problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion.

[0020] It is made for 1-20 micrometers of mean particle diameters which measure the aforementioned base raw material with a laser diffraction formula particle-size-analysis vessel to be 5-10 micrometers preferably in the desirable mode of this invention. If a mean particle diameter is set to 1 micrometer or less, the state of aggregation of a slurry will become intense, amalgam decomposition will become difficult, and a problem will be produced in a moldability. Moreover, if a mean particle diameter is set to 20 micrometers or more, **\*\***-izing of a base and mineralization cannot become inadequate and sufficient intensity cannot be obtained.

[0021] It is made for the forming method in the aforementioned forming cycle to be slurry casting in the desirable mode of this invention. According to a thing with that right, a dimensional accuracy is good and the large-sized complicated configuration article represented by the sanitary ware can be fabricated easily.

[0022] It is made for the burning temperature in the aforementioned baking process to be 1100-1300 degrees C in the desirable mode of this invention. It is possible to have the intensity [ say / 30 or more MPas ] which is satisfactory practically with flexural strength by the degree baking of high fire of 1100 degrees C - 1300 degrees C, without reducing base intensity extremely. Burning temperature cannot become inadequate [ **\*\***-izing of a low and a base and mineralization ] from 1100 degrees C, and the intensity made into an aim cannot be obtained. Since **\*\***-ized sintering will advance too much if higher than 1300 degrees C, it becomes impossible moreover, to obtain the amount of burning shrinkage and deformation which are made into an aim.

[0023]  
[Embodiments of the Invention] The example of 1 operation composition of this invention is explained based on drawing 1 below. The cover coat layer 2 is formed in the required portion on a base 1 in this invention. A base 1 consists of an earthenware simple ground with absorptivity, the surface section 3 is a part which has performed water absorption prevention processing, and absorptivity is small rather than the base 1. Composition of a base 1 is 2:45 - 70 % of the weight of SiO(s), and 2O3:25 - 50 % of the weight of aluminum. The total amount of at least one sort of alkali-metal oxides chosen from the group which consists of Na2O, K2O, and Li2O is 2 or less % of the weight. The total amount of at least one sort of alkaline-earth-metal oxides chosen from the group which serves as at least one sort of alkali-metal oxides chosen from the group which consists of Na2O, K2O, and Li2O from CaO, MgO, BaO, and BeO is 6 or less % of the weight. By stopping low the composition ratio of the alkali metal and alkaline earth metal which act as a sintering acid, generation of the glass phase by sintering and **\*\***-izing is suppressed, and the deformation accompanying burning shrinkage or it becomes small. Therefore, correction is not made at the time of manufacture, but **\*\*** also serves as a good product of a dimensional accuracy. Moreover, it is the product which water does not permeate into a base and problems, such as a frost damage in delayed crazing or the cold district by the moisture expansion, cannot produce easily

from having performed water absorption prevention processing to the surface section 3 which may contact water.

[0024] The flexural strength computed when the place-equipped-with-a-water-supply product made from pottery of drawing 1 produces a  $\phi 14 \times 130$ mm test piece using the base and cover coat of the same composition and composition and a three-point bending test is carried out on condition that span 100mm and crosshead speed 2.5 mm/min by the autograph using the test piece is 30 or more MPas. Moreover, the base and cover coat of the same composition as the place-equipped-with-a-water-supply product made from pottery and composition are used. A test piece with width of face of 25mm, a thickness [ of 5mm ], and a length of 230mm is produced. After supporting the test piece by two span 200mm points, carrying out a temperature up to 1000 degrees C in 4 hours, carrying out a temperature up to 1200 more degrees C in 2 hours and holding at 1200 degrees C for 1 hour, the amount of deflections of the test piece when cooling naturally to a room temperature is 5mm or less. Furthermore, the line coefficient of thermal expansion of the longitudinal direction of the test piece when producing a test piece using the base and cover coat of the same composition as pottery and composition is less than [  $90 \times 10^{-7} / \text{degree C}$  ].

[0025] A problem does not arise in sanitation sides, such as delayed crazing by the moisture expansion, a frost damage, and contamination, the above-mentioned pottery does not make correction at the time of manufacture, but the precision of \*\* of a product size is [ the pottery ] good. Therefore, it can use for a lavatory, a urinal, a closet, a baby bus, a washhand basin, a toilet bowl tank, etc. broadly.

[0026] The place-equipped-with-a-water-supply product made from pottery of drawing 1 is producible by the method shown below. The base manufacture process which produces a base [ in which the mean particle diameter which performs grain refining of the ceramic industry raw material which makes a principal component  $\text{SiO}_2$  and aluminum  $2\text{O}_3$ , and is measured with a laser diffraction formula particle-size-analysis vessel is 1-20 micrometers ] raw material, The forming cycle which forms a forming base by methods, such as slurry casting, the dryness process which dries the aforementioned forming base, After performing a baking process at the glazing process and the temperature of 1100-1300 degrees C which apply a cover coat on the aforementioned forming base, in the portion in which the cover coat layer is not formed And the process which applies the permeability water absorption inhibitor of a silane system, a siloxane system, and a silica system by brush coating, dipping, or the air spray is performed in the surface section 3 which may contact the interior of a headrace, and water. When the place-equipped-with-a-water-supply product made from pottery is produced by the above-mentioned method, at a baking process A test-piece Plastic solid with the width of face 30 which the amount of contraction of a longitudinal direction comes to be 7% or less at least, and produced even the process before dryness on the same conditions as pottery, a thickness [ 15 ], and a length of 260mm is supported by span 200mm. The amount of deflections when calcinating on the same baking conditions as pottery converts in the baking object thickness of 10mm fairly, and comes to be 20mm or less.

[0027] Next, the ceramic industry raw material used for this invention is explained. A ceramic industry raw material points to the both sides of the raw material currently used as a usual \*\*-ized simple ground raw material, and the raw material currently used as a refractories raw material. Here, \*\*-ized simple ground raw materials are a pottery stone, a feldspar, silica, a mica, a kaolin, frog clay, kibushi clay, a dolomite, etc., and refractories raw materials are agalmatolite, a van soil shale, a chamotte, agalmatolite clay, fire clay, a flint clay, a bauxite, a magnesia clinker, etc. As for a \*\*-ized simple ground raw material and a refractories raw material, using together is desirable. It is because it is easier than the case where a base is prepared by composition of only a \*\*-ized simple ground raw material for the way where an alkali-metal oxide and alkaline-earth-metal oxide content made refractories raw materials, such as low agalmatolite and a chamotte raw material, use together to decrease the alkali-metal oxide and alkaline-earth-metal oxide in a base.

[0028]

[Example] Base preparation and the chemical composition of the example of this invention and the example of comparison, and a crystal mineral are shown in drawing 2 . The base manufacture method carried out wet grinding of what carried out weighing capacity of the predetermined raw material, and

carried out proper quantity addition of the silicate of soda as the water 35 section and a deflocculant in the pot mill, and prepared the mean particle diameter to 6 micrometers. Next, the raw material slurry was slushed into the plaster mold which can be fabricated in the predetermined configuration of the sample for physical-properties measurement, it unmolded after impression fabrication, and the test piece was fabricated. It calcinated by the heat curve which carries out it to 1000 degrees C with an electric furnace after a test piece carries out 24hr dryness at 40 degrees C, and carries out a temperature up to 1200 degrees C in 2 hours for 4 hours and which is cooled naturally after 1-hour maintenance at 1200 degrees C. Next, about examples 1-5, only the surface section applied the silane system permeability water absorption inhibitor by brush coating, dipping, and the air spray, and carried out 6hr dryness at 40 degrees C. Moreover, the silica system permeability water absorption inhibitor was applied by dipping, and 6hr dryness was carried out at 40 degrees C.

[0029] Base flexural strength is the value measured by the  $\phi 14 \times 130$ mm test piece by the method of bending three points on condition that span 100mm and crosshead speed 2.5 mm/min by the Shimadzu autograph.

[0030] Baking deformation supports the test piece (base in which it does not calcinate) with width of face 30, a thickness [ 15 ], and a length of 260mm, by span 200mm at the time of baking, and is the value which measured the amount of deflections after baking, and the thickness of a test piece. Since the amount of deflections at this time is in inverse proportion to the square of the thickness of the test piece after baking, it makes deformation the amount of deflections converted when thickness was 10mm by the following formula.

Amount measured-value of baking deformation = deflections (thickness of test piece after baking)

2/102[0031] The deformation at the time of reheating supports a test piece (baking base) with width of face of 25mm, a thickness [ of 5mm ], and a length of 230mm by two span 200mm points, it carries out a temperature up to 1000 degrees C in 4 hours, and it carries out a temperature up to 1200 more degrees C in 2 hours, and after holding at 1200 degrees C for 1 hour, it makes the amount of deflections of the test piece when cooling naturally to a room temperature the deformation at the time of reheating. However, about the case where the thickness of a test piece is not 5mm, the amount of deflections makes the value amended since it was in inverse proportion to the thickness of a test piece the deformation at the time of reheating. The amendment method surveys deformation at the time of reheating by the test piece of two kinds of different thickness, computes n by the following formula, and calculates the deformation at the time of reheating in case the thickness of a test piece is 5mm further.

deformation 2 = deformation 1  $\times$  (1/thickness 2 of thickness) n deformation 1: -- deformation deformation 2: at the time of reheating by the test piece of thickness 1 -- deformation n: at the time of reheating by the test piece of thickness 2 -- the constant for amendment [0032] It substitutes for the base fracture surface as ink penetrances other than the surface section. After carrying out about the measuring method according to JISA5207, making a test piece with width of face 30, a thickness [ 15 ], and a length of 130mm fracture, making the fracture surface immersed for 1 hour or more in a red ink solution (eosine Y solution of 1% of concentration) and wiping off ink, it is the value which measured the maximum osmosis size which permeated in the base.

[0033] A surface section ink penetrance Width of face 30, thickness 15, the rear face of a test piece with a length of 130mm, So that red ink may not permeate the portion to which water absorption prevention processings, such as a cross section, are not performed Paraffin, After carrying out filling by the resin etc., and the surface section makes 1 or more hrs immersed in the red ink solution (eosine Y solution of 1% of concentration) of an amount immersed enough and wipes off ink, it is the value which measured the maximum osmosis size which fractured the sample and permeated in the base.

[0034] The physical properties and chemical analysis of an example and the example of comparison are shown in drawing 3 . The example 1 of comparison is general \*-ized simple ground composition, and since sintering is advancing completely, the fracture surface and the surface section of an ink penetrance are 0.1mm. However, it turns out that burning shrinkage and deformation show the biggest value. The example 2 of comparison is the composition which substituted for the feldspar with which many sintering-acid components are contained, and the dolomite from the example 1 of comparison to the

kaolin. The amount of an alkali-metal oxide is 2 % of the weight or more, it is still as large as the burning shrinkage of 7.3%, and the deformation of 19.2mm, and since water absorption prevention processing of the surface section has not been performed, an ink penetrance is in the state where the water absorption from a front face cannot be prevented at all, in 8.0mm or more. The example 3 of comparison is the case where refractories raw materials, such as a chamotte, are used together, and is the preparation which decreased the amount of alkali-metal oxides of the base itself, and the amount of alkaline-earth-metal oxides as much as possible. In this case, 3.5%, a burning shrinkage is 4.8mm in deformation, and is quite small. However, since water absorption prevention processing of the surface section has not been performed, the ink penetrance from the surface section is 8.0mm or more, and water absorption is in the state which has not been prevented at all like the example 2 of comparison.

[0035] An example 1 is the same composition as the example 2 of comparison, and carries out the brush coating application of the silane system permeability water absorption inhibitor at the surface section. The ink penetrance from the surface section is 0.5mm to the ink penetrances of the fracture surface being 8.0mm or more and porosity. However, the amount of the alkali-metal oxide of the base itself is 2 % of the weight or more, and has become height a little about burning shrinkage and deformation. An example 2 is the same composition as the example 3 of comparison, and carries out the brush coating application of the silane system permeability water absorption inhibitor. The ink penetrance of the surface section is 0.5mm, and 3.5%, a burning shrinkage is 4.8mm in deformation, and is very small.

[0036] An example 3 is the same composition as the example 3 of comparison, and carries out the dipping application of the silane system permeability water absorption inhibitor at the surface section. The ink penetrance from the surface section is 0.1mm, and has acquired the water absorption prevention effect nearly completely. An example 4 is the same composition as the example 3 of comparison, and carries out the air-spray application of the silane system permeability water absorption inhibitor at the surface section. The ink penetrance from the surface section is 0.3mm, and although the water absorption prevention effect is inferior to a dipping application a little, it has acquired practically sufficient water absorption prevention effect. An example 5 is the same composition as the example 3 of comparison, and carries out the dipping application of the silica system permeability water absorption inhibitor at the surface section. Also in this case, the ink penetrance has acquired 0.8mm and sufficient water absorption prevention effect.

[0037]

[Effect of the Invention] According to this invention, a problem cannot arise in health sides, such as delayed crazing by the moisture expansion, a frost damage, and contamination, and correction cannot be made at the time of manufacture, but suppose that offer of the place-equipped-with-a-water-supply product made from pottery with a good precision of a product size is possible also for \*\*.

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TECHNICAL FIELD

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[The technical field to which invention belongs] this invention relates to the place-equipped-with-a-water-supply product made from pottery represented by sanitary wares, such as a closet, a urinal, and a lavatory, and its manufacture method.

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PRIOR ART

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[Description of the Prior Art] The base has exposed the pottery product, without forming the cover coat layer only in the required portion of the pottery simple ground, for example, generally, forming a cover coat layer in a closet headrace and the floor installation section of a toilet bowl.

[0003] Therefore, since earthenware generally has water absorption when a base is formed qualitatively of earthenware, water may permeate a base through the above-mentioned base outcrop, and problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion, may arise. Then, conventionally, by making it \*\*\*\*\*-ize, made the glass phase generate, and the glass phase filled the crevice between the particles in a base, the whole base was made to turn precisely, and the device which abolishes absorptivity has been made.

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EFFECT OF THE INVENTION

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[Effect of the Invention] According to this invention, a problem cannot arise in health sides, such as delayed crazing by the moisture expansion, a frost damage, and contamination, and correction cannot be made at the time of manufacture, but suppose that offer of the place-equipped-with-a-water-supply product made from pottery with a good precision of a product size is possible also for \*\*.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, passing through such a sintering process made big burning shrinkage and deformation of a base produce, and it had become the cause of worsening the precision of a product size. Namely, although the so-called rate credit of deducing the raw size configuration where the deformation accompanying the amount of burning shrinkage or contraction was taken into consideration was performed in order to obtain the product size made into an aim, since burning shrinkage was large, the variation by the firing environments etc. was also large and needed the correction by grinding etc. depending on the case. this invention is for it to be made in view of the above-mentioned situation, and for a problem not produce the purpose in health sides, such as delayed crazing by the moisture expansion, a frost damage, and contamination, not make correction at the time of manufacture, but suppose that offer of the place-equipped-with-a-water-supply product made from pottery with a good precision of a product size is possible also for \*\*.

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MEANS

[Means for Solving the Problem] It is the place-equipped-with-a-water-supply product made from pottery which consists of a cover coat layer formed in a base and the required portion on it in this invention that the above-mentioned technical problem should be solved. It is the portion in which the center section of the aforementioned base becomes from the earthenware simple ground with absorptivity, and the cover coat layer is not formed at least among the surface sections of the aforementioned base. And the portion which may contact the interior of a headrace and water offers the place-equipped-with-a-water-supply product made from pottery characterized by absorptivity being smaller than the center section of the aforementioned base. It is the portion in which the contraction and deformation at the time of baking can be suppressed as much as possible, it can produce, and the cover coat layer is not formed at least among the surface sections of a base by doing so since the center section of the base is an earthenware simple ground with absorptivity. And since absorptivity is smaller than the center section of the aforementioned base, the water absorption in a base outcrop is suppressed and problems, such as a frost damage in delayed crazing or the cold district by the moisture expansion, cannot produce easily the portion which may contact the interior of a headrace, and water.

[0006] It is the place-equipped-with-a-water-supply product made from pottery which consists of a cover coat layer formed in a base and the required portion on it, and the center section of the aforementioned base has an ink penetrance larger than 3mm, and it is the portion in which the cover coat layer is not formed at least among the surface sections of the aforementioned base, and is made for the ink penetrance of the portion which may contact the interior of a headrace and water to be 3mm or less in the desirable mode of this invention. By doing so, since the center section of the base is the earthenware simple ground where an ink penetrance has absorptivity by 3mm or more and porosity in the portion in which the contraction and deformation at the time of baking can be suppressed as much as possible, it can produce, and the cover coat layer is not formed at least among the surface sections of a base. And since an ink penetrance is 3mm or less, the water absorption from a base outcrop is suppressed and problems, such as a frost damage in delayed crazing or the cold district by the moisture expansion, cannot produce easily the portion which may contact the interior of a headrace, and water.

[0007] Composition of the principal component which constitutes a base in the desirable mode of this invention. They are 2:45 - 70 % of the weight of SiO(s), and 2O3:25 - 50 % of the weight of aluminum. The total amount of at least one sort of alkali-metal oxides chosen from the group which consists of Na<sub>2</sub>O, K<sub>2</sub>O, and Li<sub>2</sub>O is 2 or less % of the weight. It is made for the total amount of at least one sort of alkaline-earth-metal oxides chosen from the group which serves as at least one sort of alkali-metal oxides chosen from the group which consists of Na<sub>2</sub>O, K<sub>2</sub>O, and Li<sub>2</sub>O from CaO, MgO, BaO, and BeO to be 6 or less % of the weight. By stopping low the composition ratio of the alkali metal and alkaline earth metal which act as a sintering acid, generation of the glass phase by sintering and \*-izing is suppressed, and the deformation accompanying burning shrinkage or it becomes small.

[0008] It is made for a quartz, a cristobalite, a mullite, and at least one sort of minerals chosen from the group which consists of corundum to contain as a crystal further on the aforementioned base in the desirable mode of this invention. The intensity of a base improves by doing so.

[0009] It is made for the amount of contraction of the longitudinal direction of the test piece when producing a test piece with width of face of 25mm, a thickness [ of 5mm ], and a length of 230mm using the same base and same cover coat as the aforementioned place-equipped-with-a-water-supply product made from pottery to be 7% or less in the desirable mode of this invention. By doing so, burning shrinkage is small and the product by which the dimensional accuracy was stabilized can be obtained.

[0010] In the desirable mode of this invention, the same base and same cover coat as the aforementioned place-equipped-with-a-water-supply product made from pottery are used. A  $\phi 14 \times 130$ mm test piece is produced and the test piece is used. by the autograph Span 100mm, The flexural strength computed when a three-point bending test is carried out on condition that crosshead speed 2.5 mm/min is 30 or more MPas. The same base and same cover coat as the aforementioned pottery are used. And width of face of 25mm, thickness of 5mm, Produce a test piece with a length of 230mm and the test piece is supported by two span 200mm points. After carrying out a temperature up to 1000 degrees C in 4 hours, carrying out a temperature up to 1200 more degrees C in 2 hours and holding at 1200 degrees C for 1 hour, it is made for the amount of deflections of the test piece when cooling naturally to a room temperature to be 5mm or less. By doing so, it has intensity usually usable as a product, and baking deformation is small and can obtain the product by which the dimensional accuracy was stabilized.

[0011] It is made for the line coefficient of thermal expansion of the longitudinal direction of the test piece when producing a test piece using the still more nearly same base and cover coat as the aforementioned make place-equipped-with-a-water-supply product pottery to be less than [  $90 \times 10^{-7} / \text{degree C}$  ] in the desirable mode of this invention. Matching with the cover coat currently generally used for the pottery product is good, and it is hard coming to generate fault generating of cover coat sides, such as a glaze jump and intrusion, by doing so. Moreover, the base piece in the cooling process at the time of the baking process of the base itself is suppressed, and a thermal shock resistance improves further.

[0012] In the 1 manufacture method of the place-equipped-with-a-water-supply product made from pottery of this invention The base manufacture process which produces a base raw material by performing grain refining of the ceramic industry raw material which makes a principal component  $\text{SiO}_2$  and aluminum  $2\text{O}_3$ , After performing the forming cycle which forms a forming base, the dryness process which dries the aforementioned forming base, the glazing process which applies a cover coat on the aforementioned forming base, and a baking process, in the portion in which the cover coat layer is not formed And it is made to perform the process which performs water absorption prevention processing to the surface section which may contact the interior of a headrace, and water. By doing so, osmosis of the water from the surface section which may contact the interior of a headrace and water can be prevented, and it is hard to produce problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion. <BR> [0013] In the process which performs the aforementioned water absorption prevention processing, the same water absorption prevention effect can be acquired by applying coating agents, such as organic and an inorganic water absorption inhibitor, a sealer, and a primer, a filler, etc. to common paint rows, such as the oil paint by which Kamiichi is carried out, lacquer, alkyd resin coating, vinyl resin coating, acrylic resin coating, epoxy resin coating, polyurethane resin enamels and varnishes, a polyester resin paint, and silicone coating. It is made to be the process to which the process which performs the aforementioned water absorption prevention processing in the more desirable mode of this invention furthermore applies the permeability water absorption inhibitor of a silane system, a siloxane system, and a silica system. By doing so, by the silane system and the siloxane system permeability water absorption inhibitor, since a water absorption prevention layer powerful from the surface section to several mm range is generated when a permeability water absorption inhibitor permeates into a base and combines with the silanol group in a base chemically, it can be rich in endurance and the prolonged water absorption prevention effect can be acquired. Moreover, in a silica system permeability water absorption inhibitor, a silica particle enters into the pore in a base, and can acquire the water absorption prevention effect semipermanently restoration and by carrying out closed \*\* for the pore itself. Therefore, it is hard to produce problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion.

[0014] the method of application of the water absorption inhibitor in the process which performs the aforementioned water absorption prevention processing -- setting -- brush coating, roller brush coating, and a trowel -- the general methods of application, such as coating, are applicable. It is made for the process which furthermore performs the aforementioned water absorption prevention processing in the more desirable mode of this invention to be a dipping method. It can apply also to a portion like the interior of the interior of a headrace and overflow of a lavatory represented with doing so by the interior of a trap or the rim of a closet and a urinal, and a toilet bowl tank which is hard to apply easily.

[0015] It is made for the method of application of the water absorption inhibitor in the process which furthermore performs the aforementioned water absorption prevention processing to be the atomization method represented by the air-spray method. By doing so, the atomization of a water absorption inhibitor is made and it can apply also to a portion like the interior of the interior of a headrace and overflow of a lavatory represented by the interior of a trap or the rim of a closet and a urinal, and a toilet bowl tank which is hard to apply easily.

[0016] The place-equipped-with-a-water-supply product made from pottery which applies the aforementioned water absorption inhibitor is a closet, and it is made for the aforementioned predetermined surface sections to be the interior of a headrace represented by the interior of a trap, or the rim, and/or a part which contacts a wall and a floor line at the time of closet installation. A headrace shows the part which a wash water lets flow like the ZETT hole in the case of washing not only with a rim but with a closet. To the part which may contact the water in a closet by doing so, water absorption prevention processing will be performed and it is hard to produce problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion.

[0017] The place-equipped-with-a-water-supply product made from pottery which applies the aforementioned water absorption inhibitor is a lavatory, and it is made for the aforementioned predetermined surface section to be the interior of overflow. To the part which may contact the water in a lavatory by doing so, water absorption prevention processing will be performed and it is hard to produce problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion.

[0018] The pottery which applies the aforementioned water absorption inhibitor is a urinal, and it is made for the aforementioned predetermined surface sections to be the interior of a trap or a headrace, and/or a part which contacts a wall and a floor line at the time of urinal installation. To the part which may contact the water in a urinal by doing so, water absorption prevention processing will be performed and it is hard to produce problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion.

[0019] The pottery which applies the aforementioned water absorption inhibitor is a toilet bowl tank, and it is made for the aforementioned predetermined surface sections to be the interior of a toilet bowl tank, and/or the tank base unglazed section. To the part which may contact the water in a toilet bowl tank by doing so, water absorption prevention processing will be performed and it is hard to produce problems, such as a frost damage in delayed crazing and the cold district by the moisture expansion.

[0020] It is made for 1-20 micrometers of mean particle diameters which measure the aforementioned base raw material with a laser diffraction formula particle-size-analysis vessel to be 5-10 micrometers preferably in the desirable mode of this invention. If a mean particle diameter is set to 1 micrometer or less, the state of aggregation of a slurry will become intense, amalgam decomposition will become difficult, and a problem will be produced in a moldability. Moreover, if a mean particle diameter is set to 20 micrometers or more, \*-izing of a base and mineralization cannot become inadequate and sufficient intensity cannot be obtained.

[0021] It is made for the forming method in the aforementioned forming cycle to be slurry casting in the desirable mode of this invention. According to a thing with that right, a dimensional accuracy is good and the large-sized complicated configuration article represented by the sanitary ware can be fabricated easily.

[0022] It is made for the burning temperature in the aforementioned baking process to be 1100-1300 degrees C in the desirable mode of this invention. It is possible to have the intensity [ say / 30 or more

MPas ] which is satisfactory practically with flexural strength by the degree baking of high fire of 1100 degrees C - 1300 degrees C, without reducing base intensity extremely. If burning temperature is lower than 1100 degrees C, \*\*izing of a base and mineralization cannot become inadequate, and the intensity made into an aim cannot be obtained. Since \*\*ized sintering will advance too much if higher than 1300 degrees C, it becomes impossible moreover, to obtain the amount of burning shrinkage and deformation which are made into an aim.

[0023]

[Embodiments of the Invention] The example of 1 operation composition of this invention is explained based on drawing 1 below. The cover coat layer 2 is formed in the required portion on a base 1 in this invention. A base 1 consists of an earthenware simple ground with absorptivity, the surface section 3 is a part which has performed water absorption prevention processing, and absorptivity is small rather than the base 1. Composition of a base 1 is 2:45 - 70 % of the weight of SiO(s), and 2O3:25 - 50 % of the weight of aluminum. The total amount of at least one sort of alkali-metal oxides chosen from the group which consists of Na2O, K2O, and Li2O is 2 or less % of the weight. The total amount of at least one sort of alkaline-earth-metal oxides chosen from the group which serves as at least one sort of alkali-metal oxides chosen from the group which consists of Na2O, K2O, and Li2O from CaO, MgO, BaO, and BeO is 6 or less % of the weight. By stopping low the composition ratio of the alkali metal and alkaline earth metal which act as a sintering acid, generation of the glass phase by sintering and \*\*izing is suppressed, and the deformation accompanying burning shrinkage or it becomes small. Therefore, correction is not made at the time of manufacture, but \*\* also serves as a good product of a dimensional accuracy. Moreover, it is the product which water does not permeate into a base and problems, such as a frost damage in delayed crazing or the cold district by the moisture expansion, cannot produce easily from having performed water absorption prevention processing to the surface section 3 which may contact water.

[0024] The flexural strength computed when the place-equipped-with-a-water-supply product made from pottery of drawing 1 produces a  $\phi 14 \times 130$ mm test piece using the base and cover coat of the same composition and composition and a three-point bending test is carried out on condition that span 100mm and crosshead speed 2.5 mm/min by the autograph using the test piece is 30 or more MPas. Moreover, the base and cover coat of the same composition as the place-equipped-with-a-water-supply product made from pottery and composition are used. A test piece with width of face of 25mm, a thickness [ of 5mm ], and a length of 230mm is produced. After supporting the test piece by two span 200mm points, carrying out a temperature up to 1000 degrees C in 4 hours, carrying out a temperature up to 1200 more degrees C in 2 hours and holding at 1200 degrees C for 1 hour, the amount of deflections of the test piece when cooling naturally to a room temperature is 5mm or less. Furthermore, the line coefficient of thermal expansion of the longitudinal direction of the test piece when producing a test piece using the base and cover coat of the same composition as pottery and composition is less than [  $90 \times 10^{-7} / \text{degree C}$  ].

[0025] A problem does not arise in sanitation sides, such as delayed crazing by the moisture expansion, a frost damage, and contamination, the above-mentioned pottery does not make correction at the time of manufacture, but the precision of \*\* of a product size is [ the pottery ] good. Therefore, it can use for a lavatory, a urinal, a closet, a baby bus, a washhand basin, a toilet bowl tank, etc. broadly.

[0026] The place-equipped-with-a-water-supply product made from pottery of drawing 1 is producible by the method shown below. The base manufacture process which produces a base [ in which the mean particle diameter which performs grain refining of the ceramic industry raw material which makes a principal component SiO2 and aluminum 2O3, and is measured with a laser diffraction formula particle-size-analysis vessel is 1-20 micrometers ] raw material, The forming cycle which forms a forming base by methods, such as slurry casting, the dryness process which dries the aforementioned forming base, After performing a baking process at the glazing process and the temperature of 1100-1300 degrees C which apply a cover coat on the aforementioned forming base, in the portion in which the cover coat layer is not formed And the process which applies the permeability water absorption inhibitor of a silane system, a siloxane system, and a silica system by brush coating, dipping, or the air spray is performed in

the surface section 3 which may contact the interior of a headrace, and water. When the place-equipped-with-a-water-supply product made from pottery is produced by the above-mentioned method, at a baking process A test-piece Plastic solid with the width of face 30 which the amount of contraction of a longitudinal direction comes to be 7% or less at least, and produced even the process before dryness on the same conditions as pottery, a thickness [ 15 ], and a length of 260mm is supported by span 200mm. The amount of deflections when calcinating on the same baking conditions as pottery converts in the baking object thickness of 10mm fairly, and comes to be 20mm or less.

[0027] Next, the ceramic industry raw material used for this invention is explained. A ceramic industry raw material points to the both sides of the raw material currently used as a usual \*\* -ized simple ground raw material, and the raw material currently used as a refractories raw material. Here, \*\* -ized simple ground raw materials are a pottery stone, a feldspar, silica, a mica, a kaolin, frog clay, kibushi clay, a dolomite, etc., and refractories raw materials are agalmatolite, a van soil shale, a chamotte, agalmatolite clay, fire clay, a flint clay, a bauxite, a magnesia clinker, etc. As for a \*\* -ized simple ground raw material and a refractories raw material, using together is desirable. It is because it is easier than the case where a base is prepared by composition of only a \*\* -ized simple ground raw material for the way where an alkali-metal oxide and alkaline-earth-metal oxide content made refractories raw materials, such as low agalmatolite and a chamotte raw material, use together to decrease the alkali-metal oxide and alkaline-earth-metal oxide in a base.

[0028]

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## EXAMPLE

[Example] Base preparation and the chemical composition of the example of this invention and the example of comparison, and a crystal mineral are shown in drawing 2. The base manufacture method carried out wet grinding of what carried out weighing capacity of the predetermined raw material, and carried out optimum dose addition of the silicate of soda as the water 35 section and a deflocculant in the pot mill, and prepared the mean particle diameter to 6 micrometers. Next, the raw material slurry was slushed into the plaster mold which can be fabricated in the predetermined configuration of the sample for physical-properties measurement, it unmolded after impression fabrication, and the test piece was fabricated. It calcinated by the heat curve which carries out it to 1000 degrees C with an electric furnace after a test piece carries out 24hr dryness at 40 degrees C, and carries out a temperature up to 1200 degrees C in 2 hours for 4 hours and which is cooled naturally after 1-hour maintenance at 1200 degrees C. Next, about examples 1-5, only the surface section applied the silane system permeability water absorption inhibitor by brush coating, dipping, and the air spray, and carried out 6hr dryness at 40 degrees C. Moreover, the silica system permeability water absorption inhibitor was applied by dipping, and 6hr dryness was carried out at 40 degrees C.

[0029] Base flexural strength is the value measured by the  $\phi 14 \times 130$ mm test piece by the method of bending three points on condition that span 100mm and crosshead speed 2.5 mm/min by the Shimazu autograph.

[0030] Baking deformation supports the test piece (base in which it does not calcinate) with width of face 30, a thickness [ 15 ], and a length of 260mm, by span 200mm at the time of baking, and is the value which measured the amount of deflections after baking, and the thickness of a test piece. Since the amount of deflections at this time is in inverse proportion to the square of the thickness of the test piece after baking, it makes deformation the amount of deflections converted when thickness was 10mm by the following formula.

Amount measured-value x of baking deformation = deflections (thickness of test piece after baking)  $2/102$  [0031] The deformation at the time of reheating supports a test piece (baking base) with width of face of 25mm, a thickness [ of 5mm ], and a length of 230mm by two span 200mm points, it carries out a temperature up to 1000 degrees C in 4 hours, and it carries out a temperature up to 1200 more degrees C in 2 hours, and after holding at 1200 degrees C for 1 hour, it makes the amount of deflections of the test piece when cooling naturally to a room temperature the deformation at the time of reheating. However, about the case where the thickness of a test piece is not 5mm, the amount of deflections makes the value amended since it was in inverse proportion to the thickness of a test piece the deformation at the time of reheating. The amendment method surveys deformation at the time of reheating by the test piece of two kinds of different thickness, computes n by the following formula, and calculates the deformation at the time of reheating in case the thickness of a test piece is 5mm further.

deformation 2 = deformation 1  $\times (1/\text{thickness 2 of thickness})$  n deformation 1: -- deformation deformation 2: at the time of reheating by the test piece of thickness 1 -- deformation n: at the time of reheating by the test piece of thickness 2 -- the constant for amendment [0032] It substitutes for the base fracture surface as ink penetrances other than the surface section. After carrying out about the measuring method

according to JISA5207, making a test piece with width of face 30, a thickness [ 15 ], and a length of 130mm fracture, making the fracture surface immersed for 1 hour or more in a red ink solution (eosine Y solution of 1% of concentration) and wiping off ink, it is the value which measured the maximum osmosis size which permeated in the base.

[0033] A surface section ink penetrance Width of face 30, thickness 15, the rear face of a test piece with a length of 130mm, So that red ink may not permeate the portion to which water absorption prevention processings, such as a cross section, are not performed Paraffin, After carrying out filling by the resin etc., and the surface section makes 1 or more hrs immersed in the red ink solution (eosine Y solution of 1% of concentration) of an amount immersed enough and wipes off ink, it is the value which measured the maximum osmosis size which fractured the sample and permeated in the base.

[0034] The physical properties and chemical analysis of an example and the example of comparison are shown in drawing 3 . The example 1 of comparison is general \*\*-ized simple ground composition, and since sintering is advancing completely, the fracture surface and the surface section of an ink penetrance are 0.1mm. However, it turns out that burning shrinkage and deformation show the biggest value. The example 2 of comparison is the composition which substituted for the feldspar with which many sintering-acid components are contained, and the dolomite from the example 1 of comparison to the kaolin. The amount of an alkali-metal oxide is 2 % of the weight or more, it is still as large as the burning shrinkage of 7.3%, and the deformation of 19.2mm, and since water absorption prevention processing of the surface section has not been performed, an ink penetrance is in the state where the water absorption from a front face cannot be prevented at all, in 8.0mm or more. The example 3 of comparison is the case where refractories raw materials, such as a chamotte, are used together, and is the preparation which decreased the amount of alkali-metal oxides of the base itself, and the amount of alkaline-earth-metal oxides as much as possible. In this case, 3.5%, a burning shrinkage is 4.8mm in deformation, and is quite small. However, since water absorption prevention processing of the surface section has not been performed, the ink penetrance from the surface section is 8.0mm or more, and water absorption is in the state which has not been prevented at all like the example 2 of comparison.

[0035] An example 1 is the same composition as the example 2 of comparison, and carries out the brush coating application of the silane system permeability water absorption inhibitor at the surface section. The ink penetrance from the surface section is 0.5mm to the ink penetrances of the fracture surface being 8.0mm or more and porosity. However, the amount of the alkali-metal oxide of the base itself is 2 % of the weight or more, and has become height a little about burning shrinkage and deformation. An example 2 is the same composition as the example 3 of comparison, and carries out the brush coating application of the silane system permeability water absorption inhibitor. The ink penetrance of the surface section is 0.5mm, and 3.5%, a burning shrinkage is 4.8mm in deformation, and is very small.

[0036] An example 3 is the same composition as the example 3 of comparison, and carries out the dipping application of the silane system permeability water absorption inhibitor at the surface section. The ink penetrance from the surface section is 0.1mm, and has acquired the water absorption prevention effect nearly completely. An example 4 is the same composition as the example 3 of comparison, and carries out the air-spray application of the silane system permeability water absorption inhibitor at the surface section. The ink penetrance from the surface section is 0.3mm, and although the water absorption prevention effect is inferior to a dipping application a little, it has acquired practically sufficient water absorption prevention effect. An example 5 is the same composition as the example 3 of comparison, and carries out the dipping application of the silica system permeability water absorption inhibitor at the surface section. Also in this case, the ink penetrance has acquired 0.8mm and sufficient water absorption prevention effect.

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[Translation done.]

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the cross section of the common seat formula toilet bowl of the example of 1 operation composition concerning this invention.

(a) The cross section of the cross direction of a seat formula toilet bowl

(b) The enlarged view of a rim cross section

[Drawing 2] Base preparation and the chemical composition of the example of this invention, and the example of comparison, a crystal mineral.

[Drawing 3] The physical properties and chemical analysis of an example given in drawing 2 , and the example of comparison.

[Description of Notations]

1 -- Base section

2 -- Cover coat layer

3 -- Base surface section (water absorption prevention processing part)

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[Translation done.]



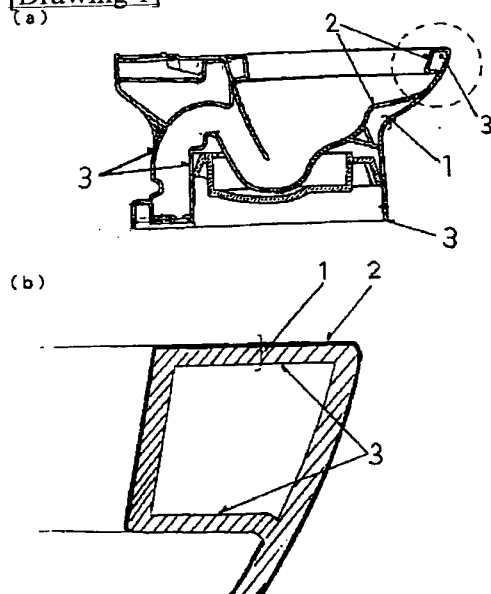
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## DRAWINGS

[Drawing 1]



リム断面 (○部) の拡大図

[Drawing 3]

素地 No.	比較例 1	比較例 2	比較例 3	実施例 1	実施例 2	実施例 3	実施例 4	実施例 5
破断面インキ浸透度 (mm)	0.1	8.0 以上						
表面部インキ浸透度 (mm)	0.1	8.0 以上	8.0 以上	0.5	0.5	0.1	0.3	0.8
焼成収縮率 (%)	10.1	7.3	3.5	7.3	3.5	3.5	3.5	3.5
変形量 (mm)	29.9	19.2	4.8	19.2	4.8	4.8	4.8	4.8
再加熱変形量 (mm)	18.3	3.6	0	3.6	0	0	0	0
曲げ強度 (MPa)	80.2	67.2	54.5	67.2	54.5	54.5	54.5	54.5
線熱膨張係数 ( $\times 10^{-7}/^{\circ}\text{C}$ )	70.3	74.8	69.2	74.8	69.2	69.2	69.2	69.2

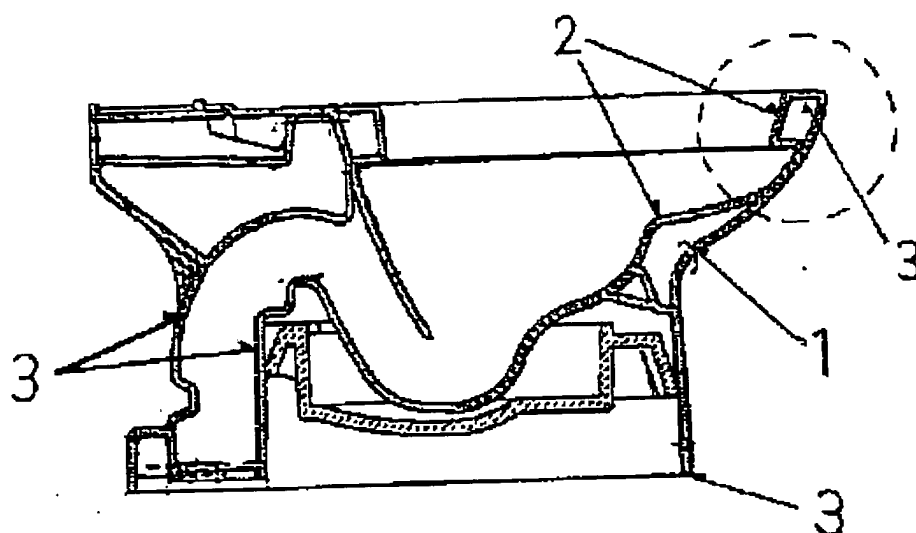
[Drawing 2]

素地 No.	比較例 1	比較例 2	比較例 3	実施例 1	実施例 2	実施例 3	実施例 4	実施例 5
原料配合 (wt%)	セリシム陶石	4.0	3.0	—	3.0	—	—	—
	シリシム陶石	2.0	3.0	2.5	3.0	2.5	2.5	2.5
	シリシ	1.5	3.0	2.0	3.0	2.0	2.0	2.0
	蜂目粘土	1.0	1.0	1.5	1.0	1.5	1.5	1.5
	長石	1.0	—	—	—	—	—	—
	ドロマイト	5	—	—	—	—	—	—
	シリシムイット	—	—	1.5	—	1.5	1.5	1.5
	燐石	—	—	1.5	—	1.5	1.5	1.5
化学組成	焼成ベントナ質岩	—	—	1.0	—	1.0	1.0	1.0
	SiO <sub>2</sub>	65.2	63.9	59.7	63.9	59.7	59.7	59.7
	Al <sub>2</sub> O <sub>3</sub>	29.5	32.0	34.6	32.0	34.6	34.6	34.6
	Na <sub>2</sub> O, CaO	2.2	0.5	0.6	0.5	0.6	0.6	0.6
	Na <sub>2</sub> O	1.6	1.0	0.2	1.1	0.2	0.2	0.2
結晶鉱物	K <sub>2</sub> O	2.0	1.4	0.7	1.7	0.7	0.7	0.7
	ムライト	○	○	○	○	○	○	○
	石英	○	○	○	○	○	○	○
	コランダム	×	○	○	○	○	○	○
表面部 吸水防止 処理	シリシム系浸透性 吸水防止剤	—	—	—	刷毛塗り	刷毛塗り	ディップ ング	エア スプレー
	シリシム系浸透性 吸水防止剤	—	—	—	—	—	—	—
		—	—	—	—	—	—	ディップ ング

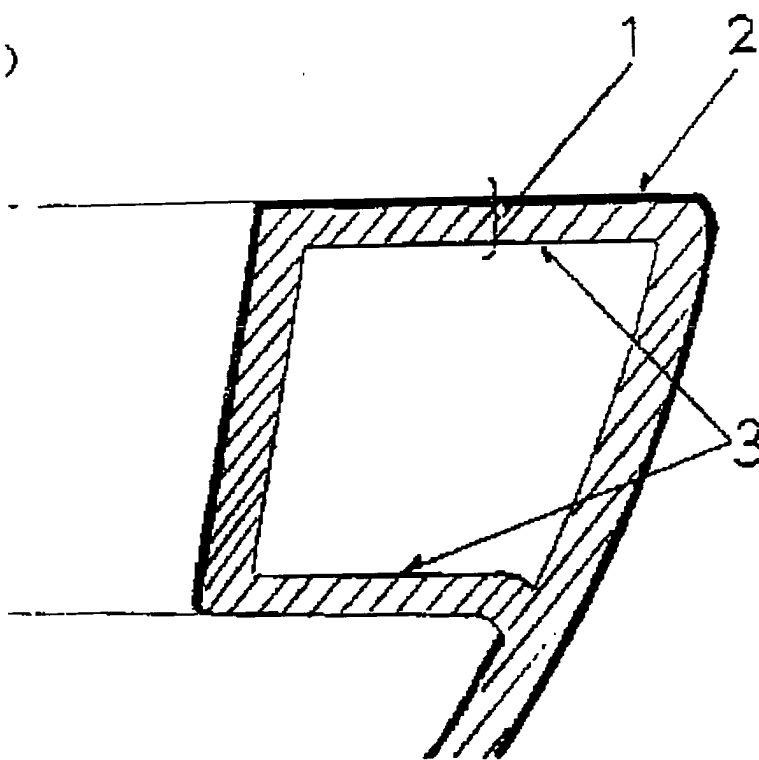
結晶鉱物欄記号説明 : ○ 素地中に結晶鉱物を含有する。 × 素地中に結晶鉱物を含有しない。

[Translation done.]

(a)



(b)



リム断面 (○部) の拡大図

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

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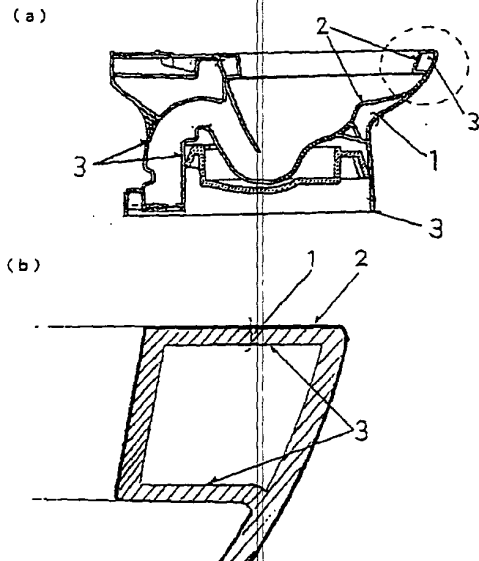
Fターム(参考) 2D039 AA01 AA04 AD01 AD04 DB04

(54) 【発明の名称】 陶磁器製水回り製品及びその製造方法

(57) 【要約】 (修正有)

【課題】 水和膨張による経年貫入、凍害、また汚染等の衛生面に問題が生じず、かつ製造時に修正作業等をせずとも製品寸法の精度の良好な陶磁器製水回り製品を提供可能とすること。

【解決手段】 素地とその上の必要な部分に形成される釉薬層からなる陶磁器製水回り製品であって、前記素地の中央部は吸水性のある陶器質素地からなり、前記素地の表面部のうち、少なくとも釉薬層が形成されていない部分で、かつ、導水路内部および水と接触する部分は、吸水性が前記素地の中央部よりも小さくなっていることを特徴とする陶磁器製水回り製品。



リム断面 (○部) の拡大図

## 【特許請求の範囲】

【請求項1】 素地とその上の必要な部分に形成される釉薬層からなる陶磁器製水回り製品であって、前記素地の中央部は吸水性のある陶器質素地からなり、前記素地の表面部のうち、少なくとも釉薬層が形成されていない部分で、かつ、導水路内部および水と接触する部分は、吸水性が前記素地の中央部よりも小さくなっていることを特徴とする陶磁器製水回り製品。

【請求項2】 素地とその上の必要な部分に形成される釉薬層からなる陶磁器製水回り製品であって、前記素地の中央部はインキ浸透度が3mmより大きく、かつ前記素地の表面部のうち、少なくとも釉薬層が形成されていない部分で、かつ、導水路内部および水と接触する部分は、インキ浸透度が3mm以下であることを特徴とする陶磁器製水回り製品。

【請求項3】 前記素地を構成する主成分の組成が、 $\text{SiO}_2$ :45~70重量%、 $\text{Al}_2\text{O}_3$ :25~50重量%であり、 $\text{Na}_2\text{O}$ 、 $\text{K}_2\text{O}$ 、 $\text{Li}_2\text{O}$ からなる群から選ばれた少なくとも1種のアルカリ金属酸化物の総量が2重量%以下であり、 $\text{Na}_2\text{O}$ 、 $\text{K}_2\text{O}$ 、 $\text{Li}_2\text{O}$ からなる群から選ばれた少なくとも1種のアルカリ金属酸化物と $\text{CaO}$ 、 $\text{MgO}$ 、 $\text{BaO}$ 、 $\text{BeO}$ からなる群から選ばれた少なくとも1種のアルカリ土類金属酸化物の総量が6重量%以下であることを特徴とする請求項1、2いずれかに記載の陶磁器製水回り製品。

【請求項4】 前記素地には、さらに、結晶として石英、クリストバライト、ムライト、コランダムからなる群から選ばれる少なくとも1種の鉱物が含有されていることを特徴とする請求項3に記載の陶磁器製水回り製品。

【請求項5】 前記陶磁器製水回り製品と同一の素地及び釉薬を用いて、幅25mm、厚み5mm、長さ230mmのテストピースを作製したときの、そのテストピースの長手方向の収縮量が7%以下であることを特徴とする請求項3、4に記載の陶磁器製水回り製品。

【請求項6】 前記陶磁器製水回り製品と同一の素地及び釉薬を用いて、 $\phi 14 \times 130$ mmのテストピースを作製し、そのテストピースを用いてオートグラフによりスパン100mm、クロスヘッドスピード2.5mm/minの条件で3点曲げ試験したときに算出される曲げ強度が30MPa以上であり、かつ、前記陶磁器製水回り製品と同一の素地及び釉薬を用いて、幅25mm、厚み5mm、長さ230mmのテストピースを作製し、そのテストピースをスパン200mmの2点で支持し、1000℃まで4時間で昇温し、さらに1200℃まで2時間で昇温し、1200℃で1時間保持した後、室温まで自然冷却したときのテストピースのたわみ量が5mm以下であることを特徴とする請求項3、4に記載の陶磁器製水回り製品。

【請求項7】 前記陶磁器製水回り製品と同一の素地及び釉薬を用いて、テストピースを作製したときの、その

テストピースの長手方向の線熱膨張係数が $90 \times 10^{-7}/^\circ\text{C}$ 以下であることを特徴とする請求項3、4記載の陶磁器製水回り製品。

【請求項8】 前記陶磁器製水回り製品は、洗面器、小便秘器、大便器、ベビーバス、手洗器、便器タンクのいずれかであることを特徴とする請求項1~7に記載の陶磁器製水回り製品。

【請求項9】 請求項1~8に記載の陶磁器製水回り製品の製造方法であって、 $\text{SiO}_2$ 、 $\text{Al}_2\text{O}_3$ を主成分とする窯業原料の粒度調整を行うことにより素地原料を作製する素地調製工程と、成形素地を形成する成形工程、前記成形素地を乾燥する乾燥工程、前記成形素地上に釉薬を適用する施釉工程、焼成工程を行った後、釉薬層が形成されていない部分で、かつ導水路内部および水と接触する可能性がある表面部に吸水防止処理を施す工程とからなることを特徴とする陶磁器製水回り製品の製造方法。

【請求項10】 前記吸水防止処理を施す工程がシラン系、シロキサン系、シリカ系の浸透性吸水防止剤を塗布する工程であることを特徴とする請求項9に記載の陶磁器製水回り製品の製造方法。

【請求項11】 前記吸水防止処理を施す工程における吸水防止剤の塗布方法がディッピング方式であることを特徴とする請求項9又は10に記載の陶磁器製水回り製品の製造方法。

【請求項12】 前記吸水防止処理を施す工程における吸水防止剤の塗布方法がエアスプレー方式に代表される霧化方式であることを特徴とする請求項9~10に記載の陶磁器製水回り製品の製造方法。

【請求項13】 前記吸水防止処理を適用する陶磁器製水回り製品が大便器であり、前記所定表面部はトラップ内部又はリムに代表される導水路内部、および/または、大便器設置時に壁、床面に接触する部位であることを特徴とする請求項9~12記載の陶磁器製水回り製品の製造方法。

【請求項14】 前記吸水防止処理を適用する陶磁器製水回り製品が洗面器であり、前記所定表面部はオーバーフロー内部であることを特徴とする請求項9~12記載の陶磁器製水回り製品の製造方法。

【請求項15】 前記吸水防止処理を適用する陶磁器製水回り製品は小便器であり、前記所定表面部はトラップ内部又は導水路内部、および/または、小便器設置時に壁、床面と接触する部位であることを特徴とする請求項9~12記載の陶磁器製水回り製品の製造方法。

【請求項16】 前記吸水防止処理を適用する陶磁器製水回り製品は便器タンクであり、前記所定表面部は、便器タンク内部、および/または、タンク底面無釉部であることを特徴とする請求項9~12記載の陶磁器製水回り製品の製造方法。

【請求項17】 前記素地原料は、レーザー回折式粒度測定器により測定する平均粒子径が1~20μmである

ことを特徴とする請求項9に記載の陶磁器製水回り製品の製造方法。

【請求項18】 前記成形工程における成形方法が泥漿鑄込み成形であることを特徴とする請求項9に記載の陶磁器製水回り製品の製造方法。

【請求項19】 前記焼成工程における焼成温度は、1100～1300℃であることを特徴とする請求項9に記載の陶磁器製水回り製品の製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、大便器、小便器、洗面器などの衛生陶器に代表される陶磁器製水回り製品及びその製造方法に関する。

【0002】

【従来の技術】陶磁器製品は、一般的に、陶磁器質素地上の必要な部分にのみ釉薬層が形成されており、例えば、大便器導水路、便器の床設置部等では釉薬層が形成されずに素地が露出している。

【0003】したがって、素地を陶器質で形成すると、一般に陶器には吸水があるため、上記素地露出部を介して水が素地に浸透し、水和膨張による経年貫入や寒冷地における凍害等の問題が生じる場合がある。そこで、従来より、焼成溶化させることにより、ガラス相を生成させ、ガラス相が素地中の粒子間の隙間を埋め、素地全体を緻密化させ、吸水性をなくす工夫がなされてきた。

【0004】

【発明が解決しようとする課題】しかしながら、このような焼結過程を経ることが、素地の大きな焼成収縮・変形を生ぜしめ、製品寸法の精度を悪化させる原因となっていた。すなわち、ねらいとする製品寸法を得るためには、焼成収縮量や収縮に伴う変形を考慮した生寸法形状を割り出すという、いわゆる割掛けを行っていたが、焼成収縮が大きいため、焼成雰囲気等によるバラツキも大きく、場合によっては、研削等による修正作業を必要としていた。本発明は、上記事情に鑑みてなされたものであり、その目的は、水和膨張による経年貫入、凍害、また汚染等の衛生面に問題が生じず、かつ製造時に修正作業等をせずとも製品寸法の精度の良好な陶磁器製水回り製品を提供可能とすることにある。

【0005】

【課題を解決するための手段】本発明では、上記課題を解決すべく、素地とその上の必要な部分に形成される釉薬層からなる陶磁器製水回り製品であって、前記素地の中央部は吸水性のある陶器質素地からなり、前記素地の表面部のうち、少なくとも釉薬層が形成されていない部分で、かつ、導水路内部および水と接触する可能性のある部分は、吸水性が前記素地の中央部よりも小さくなっていることを特徴とする陶磁器製水回り製品を提供する。そうすることで、素地の中央部は吸水性のある陶器質素地なので、焼成時の収縮・変形を可能な限り抑えて

作製可能であり、素地の表面部のうち、少なくとも釉薬層が形成されていない部分で、かつ、導水路内部および水と接触する可能性のある部分は、吸水性が前記素地の中央部よりも小さくなっているため、素地露出部における吸水が抑制され、水和膨張による経年貫入や寒冷地における凍害等の問題が生じにくい。

【0006】本発明の好ましい態様においては、素地とその上の必要な部分に形成される釉薬層からなる陶磁器製水回り製品であって、前記素地の中央部はインキ浸透度が3mmより大きく、かつ前記素地の表面部のうち、少なくとも釉薬層が形成されていない部分で、かつ、導水路内部および水と接触する可能性のある部分は、インキ浸透度が3mm以下であるようにする。そうすることで、素地の中央部はインキ浸透度が3mm以上と多孔質で吸水性のある陶器質素地なので、焼成時の収縮・変形を可能な限り抑えて作製可能であり、素地の表面部のうち、少なくとも釉薬層が形成されていない部分で、かつ、導水路内部および水と接触する可能性のある部分は、インキ浸透度が3mm以下であるため、素地露出部からの吸水が抑制され、水和膨張による経年貫入や寒冷地における凍害等の問題が生じにくい。

【0007】本発明の好ましい態様においては、素地を構成する主成分の組成が、 $\text{SiO}_2$ :45～70重量%、 $\text{Al}_2\text{O}_3$ :2.5～5.0重量%であり、 $\text{Na}_2\text{O}$ 、 $\text{K}_2\text{O}$ 、 $\text{Li}_2\text{O}$ からなる群から選ばれた少なくとも1種のアルカリ金属酸化物の総量が2重量%以下であり、 $\text{Na}_2\text{O}$ 、 $\text{K}_2\text{O}$ 、 $\text{Li}_2\text{O}$ からなる群から選ばれた少なくとも1種のアルカリ金属酸化物と $\text{CaO}$ 、 $\text{MgO}$ 、 $\text{BaO}$ 、 $\text{BeO}$ からなる群から選ばれた少なくとも1種のアルカリ土類金属酸化物の総量が6重量%以下であるようにする。焼結助剤として作用するアルカリ金属およびアルカリ土類金属の組成比を低く抑えることで、焼結・溶化によるガラス相の生成が抑制され、焼成収縮やそれに伴う変形が小さくなる。

【0008】本発明の好ましい態様においては、前記素地には、さらに、結晶として石英、クリストバライト、ムライト、コランダムからなる群から選ばれた少なくとも1種の鉱物が含有されているようにする。そうすることで、素地の強度が向上する。

【0009】本発明の好ましい態様においては、前記陶磁器製水回り製品と同一の素地及び釉薬を用いて、幅25mm、厚み5mm、長さ230mmのテストピースを作製したときの、そのテストピースの長手方向の収縮量が7%以下であるようにする。そうすることで、焼成収縮が小さく、寸法精度の安定した製品を得ることができる。

【0010】本発明の好ましい態様においては、前記陶磁器製水回り製品と同一の素地及び釉薬を用いて、 $\phi 14 \times 130$ mmのテストピースを作製し、そのテストピースを用いてオートグラフによりスパン100mm、クロスヘッドスピード2.5mm/minの条件で3点曲



げ試験したときに算出される曲げ強度が30MPa以上であり、かつ前記陶磁器と同一の素地及び釉薬を用いて、幅25mm、厚み5mm、長さ230mmのテストピースを作製し、そのテストピースをスパン200mmの2点で支持し、1000℃まで4時間で昇温し、さらに1200℃まで2時間で昇温し、1200℃で1時間保持した後、室温まで自然冷却したときのテストピースのたわみ量が5mm以下であるようにする。そうすることで、通常製品として使用可能な強度を有し、焼成変形が小さく、寸法精度の安定した製品を得ることができる。

【0011】本発明の好ましい態様においては、さらに、前記製水回り製品陶磁器と同一の素地及び釉薬を用いて、テストピースを作製したときの、そのテストピースの長手方向の線熱膨張係数が $90 \times 10^{-7}/^{\circ}\text{C}$ 以下であるようにする。そうすることで、一般的に陶磁器製品に使用されている釉薬とのマッチングが良く、釉飛び、貫入等の釉薬面の欠点発生が生じにくくなる。また、素地自体の焼成工程時の冷却過程における素地切れを抑制し、さらに耐熱衝撃性が向上する。

【0012】本発明の陶磁器製水回り製品の一製造方法においては、 $\text{SiO}_2$ 、 $\text{Al}_2\text{O}_3$ を主成分とする窯業原料の粒度調整を行うことにより素地原料を作製する素地調製工程と、成形素地を形成する成形工程、前記成形素地を乾燥する乾燥工程、前記成形素地上に釉薬を適用する施釉工程、焼成工程を行った後、釉薬層が形成されていない部分で、かつ導水路内部および水と接触する可能性がある表面部に吸水防止処理を施す工程を行うようにする。そうすることで、導水路内部および水と接触する可能性がある表面部からの水の浸透を防止することができ、水和膨張による経年貫入や寒冷地における凍害等の問題が生じにくい。

【0013】前記吸水防止処理を施す工程においては、上市されている油性塗料、ラッカー、アルキド樹脂塗料、ビニル樹脂塗料、アクリル樹脂塗料、エポキシ樹脂塗料、ポリウレタン樹脂塗料、ポリエステル樹脂塗料、シリコン樹脂塗料などの一般塗料ならびに有機・無機吸水防止剤、シーラー、プライマーなどのコーティング剤、目止め剤などを塗布することにより同様な吸水防止効果を得ることができる。さらに本発明のより好ましい態様においては、前記吸水防止処理を施す工程がシラン系、シロキサン系、シリカ系の浸透性吸水防止剤を塗布する工程であるようにする。そうすることで、シラン系、シロキサン系浸透性吸水防止剤では、浸透性吸水防止剤が素地中に浸透し、素地中のシランール基と化学的に結合することにより、表面部から数mm範囲まで強力な吸水防止層が生成されるため、耐久性に富み長期間の吸水防止効果を得ることができる。また、シリカ系浸透性吸水防止剤では、シリカ微粒子が素地中の気孔に入り込み、気孔自体を充填、クローズド化することにより、半永久的に吸水防止効果を得ることができる。したがって

て、水和膨張による経年貫入や寒冷地における凍害等の問題が生じにくい。

【0014】前記吸水防止処理を施す工程における吸水防止剤の塗布方法においては、刷毛塗り、ローラーブラシ塗り、コテ塗りなどの一般的な塗布方法を適用することができる。さらに本発明のより好ましい態様においては、前記吸水防止処理を施す工程がディッピング方式であるようにする。そうすることで、大便器、小便器のトラップ内部又はリムに代表される導水路内部や、洗面器のオーバーフロー内部、便器タンク内部のような塗布し難い部分にも容易に塗布することができる。

【0015】さらに前記吸水防止処理を施す工程における吸水防止剤の塗布方法がエアスプレー方式に代表される霧化方式であるようにする。そうすることで、吸水防止剤の霧化がなされ、大便器、小便器のトラップ内部又はリムに代表される導水路内部や、洗面器のオーバーフロー内部、便器タンク内部のような塗布し難い部分にも容易に塗布することができる。

【0016】前記吸水防止剤を適用する陶磁器製水回り製品が大便器であり、前記所定表面部はトラップ内部又はリムに代表される導水路内部、および/または、大便器設置時に壁、床面に接触する部位であるようにする。導水路とは、リムのみならず大便器ではゼット穴などのように洗浄の際に洗浄水が通水する部位を示す。そうすることで、大便器における水と接触する可能性がある部位に対して、吸水防止処理が施されることとなり、水和膨張による経年貫入や寒冷地における凍害等の問題が生じにくい。

【0017】前記吸水防止剤を適用する陶磁器製水回り製品が洗面器であり、前記所定表面部はオーバーフロー内部であるようにする。そうすることで、洗面器における水と接触する可能性がある部位に対して、吸水防止処理が施されることとなり、水和膨張による経年貫入や寒冷地における凍害等の問題が生じにくい。

【0018】前記吸水防止剤を適用する陶磁器は小便器であり、前記所定表面部はトラップ内部又は導水路内部、および/または、小便器設置時に壁、床面と接触する部位であるようにする。そうすることで、小便器における水と接触する可能性がある部位に対して、吸水防止処理が施されることとなり、水和膨張による経年貫入や寒冷地における凍害等の問題が生じにくい。

【0019】前記吸水防止剤を適用する陶磁器は便器タンクであり、前記所定表面部は、便器タンク内部、および/または、タンク底面無軸部であるようにする。そうすることで、便器タンクにおける水と接触する可能性がある部位に対して、吸水防止処理が施されることとなり、水和膨張による経年貫入や寒冷地における凍害等の問題が生じにくい。

【0020】本発明の好ましい態様においては、前記素地原料は、レーザー回折式粒度測定器により測定する平

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均粒子径が $1\sim 20\mu\text{m}$ 、好ましくは $5\sim 10\mu\text{m}$ であるようにする。平均粒子径が $1\mu\text{m}$ 以下になると、泥漿の凝集状態が激しくなって解膠が困難になり、成形性に問題を生じる。また、平均粒子径が $20\mu\text{m}$ 以上になると素地の熔化、鉍物化が不十分となり十分な強度を得ることができない。

【0021】本発明の好ましい態様においては、前記成形工程における成形方法が泥漿鑄込み成形であるようにする。そうであることにより、衛生陶器に代表される大型複雑形状品を寸法精度良く、容易に成形することができる。

【0022】本発明の好ましい態様においては、前記焼成工程における焼成温度は、 $1100\sim 1300^{\circ}\text{C}$ であるようにする。 $1100^{\circ}\text{C}\sim 1300^{\circ}\text{C}$ という高火度焼成により、素地強度を極端に低下させることなく、曲げ強度で $30\text{MPa}$ 以上という、実用上問題のない強度を有することが可能となっている。焼成温度が $1100^{\circ}\text{C}$ より低いと素地の熔化、鉍物化が不十分となり、ねらいとする強度を得ることができない。また、 $1300^{\circ}\text{C}$ より高いと熔化焼結が進行しすぎるため、ねらいとする焼成収縮量、変形量を得ることができなくなる。

【0023】

【発明の実施の形態】以下に本発明の一実施構成例について、図1に基づいて、説明する。本発明では、素地1上の必要な部分に釉薬層2が形成されている。素地1は吸水性のある陶器質素地からなり、表面部3は、吸水防止処理を施している部位であり、素地1よりも吸水性が小さくなっている。素地1の組成は、 $\text{SiO}_2:45\sim 70$ 重量%、 $\text{Al}_2\text{O}_3:25\sim 50$ 重量%であり、 $\text{Na}_2\text{O}$ 、 $\text{K}_2\text{O}$ 、 $\text{Li}_2\text{O}$ からなる群から選ばれた少なくとも1種のアルカリ金属酸化物の総量が2重量%以下であり、 $\text{Na}_2\text{O}$ 、 $\text{K}_2\text{O}$ 、 $\text{Li}_2\text{O}$ からなる群から選ばれた少なくとも1種のアルカリ金属酸化物と $\text{CaO}$ 、 $\text{MgO}$ 、 $\text{BaO}$ 、 $\text{BeO}$ からなる群から選ばれた少なくとも1種のアルカリ土類金属酸化物の総量が6重量%以下である。焼結助剤として作用するアルカリ金属およびアルカリ土類金属の組成比を低く抑えることで、焼結・熔化によるガラス相の生成が抑制され、焼成収縮やそれに伴う変形が小さくなる。したがって、製造時に修正作業等をせずとも寸法精度の良好な製品となる。また、水と接触する可能性のある表面部3に吸水防止処理を施していることより、素地中に水が浸透することがなく、水和膨張による経年貫入や寒冷地における凍害等の問題が生じにくい製品である。

【0024】図1の陶磁器製水回り製品は、同一の構成及び組成の素地及び釉薬を用いて、 $\phi 14\times 130\text{mm}$ のテストピースを作製し、そのテストピースを用いてオートグラフによりスパン $100\text{mm}$ 、クロスヘッドスピード $2.5\text{mm}/\text{min}$ の条件で3点曲げ試験したときに算出される曲げ強度が $30\text{MPa}$ 以上である。また、陶磁器製水回り製品と同一の構成及び組成の素地及び釉薬

を用いて、幅 $25\text{mm}$ 、厚み $5\text{mm}$ 、長さ $230\text{mm}$ のテストピースを作製し、そのテストピースをスパン $200\text{mm}$ の2点で支持し、 $1000^{\circ}\text{C}$ まで4時間で昇温し、さらに $1200^{\circ}\text{C}$ まで2時間で昇温し、 $1200^{\circ}\text{C}$ で1時間保持した後、室温まで自然冷却したときのテストピースのたわみ量が $5\text{mm}$ 以下である。さらに、陶磁器と同一の構成及び組成の素地及び釉薬を用いて、テストピースを作製したときの、そのテストピースの長手方向の線熱膨張係数が $90\times 10^{-7}/^{\circ}\text{C}$ 以下である。

【0025】上記陶磁器は、水和膨張による経年貫入、凍害、また汚染等の衛生面に問題が生じず、かつ製造時に修正作業等をせずとも製品寸法の精度が良好である。したがって、洗面器、小便器、大便器、ベビーバス、手洗器、便器タンク等に広範囲に利用可能である。

【0026】図1の陶磁器製水回り製品は、例えば、以下に示す方法により作製可能である。 $\text{SiO}_2$ 、 $\text{Al}_2\text{O}_3$ を主成分とする窯業原料の粒度調整を行い、レーザー回折式粒度測定器により測定する平均粒子径が $1\sim 20\mu\text{m}$ である素地原料より成形素地を形成する成形工程、前記成形等の方法により成形素地上に釉薬を適用する施釉工程、 $1100\sim 1300^{\circ}\text{C}$ の温度で焼成工程を行った後、釉薬層が形成されていない部分で、かつ、導水路内部および水と接触する可能性がある表面部3にシラン系、シロキサン系、シリカ系の浸透性吸水防止剤を刷毛塗り、ディッピングもしくは、エアスプレーで塗布する工程を行う。上記方法で陶磁器製水回り製品を作製すると、焼成工程では、少なくとも長手方向の収縮量が7%以下であるようになり、かつ乾燥前の工程までを陶磁器と同じ条件にて作製した幅 $30$ 、厚み $15$ 、長さ $260\text{mm}$ のテストピース成形体をスパン $200\text{mm}$ で支持して、陶磁器と同一の焼成条件で焼成したときのたわみ量が焼成体厚み $10\text{mm}$ 相当に換算して $20\text{mm}$ 以下であるようになる。

【0027】次に、本発明に使用される窯業原料について説明する。窯業原料とは、通常の熔化質素地原料として使用されている原料、および、耐火物原料として使用されている原料の双方をさす。ここで、熔化質素地原料とは、例えば、陶石、長石、珪石、雲母、カオリン、蛙目粘土、木節粘土、ドロマイトなどであり、耐火物原料とは、例えば、蛭石、バン土頁岩、シャモット、蛭石粘土、耐火粘土、フリントクレイ、ボーキサイト、マグネシアクリンカーなどである。熔化質素地原料と耐火物原料は併用することが望ましい。熔化質素地原料のみの組成で素地を調製した場合よりも、アルカリ金属酸化物およびアルカリ土類金属酸化物含有率が低い蛭石、シャモット原料などの耐火物原料を併用させたほうが、素地中のアルカリ金属酸化物およびアルカリ土類金属酸化物を減少させることが容易だからである。

【0028】

【実施例】図2に本発明の実施例と比較例の素地調合と化学組成、結晶鉱物を示す。素地調製方法は、所定の原材料を秤量し、水35部と解膠剤として珪酸ソーダを適量添加したものをボットミル中で湿式粉碎し、平均粒径を6 $\mu$ mに調製した。次に、原料スラリーを物性測定用サンプルの所定形状に成形可能な石膏型に流し込み、着肉成形後に脱型し、テストピースを成形した。テストピースは、40℃で24hr乾燥した後、電気炉で1000℃まで4時間、1200℃まで2時間で昇温し、1200℃で1時間保持後、自然冷却するヒートカーブにより焼成した。次に、実施例1～5については、表面部のみシラン系浸透性吸水防止剤を刷毛塗り、ディッピング、エアスプレーにより塗布し、40℃で6hr乾燥させた。また、シリカ系浸透性吸水防止剤をディッピングにより塗布し、40℃で6hr乾燥させた。

【0029】素地曲げ強度は、 $\phi 14 \times 130$ mmのテストピースにより、島津製オートグラフによりスパン100mm、クロスヘッドスピード2.5mm/minの条件で3点曲げ方法で測定した値である。

【0030】焼成変形量は、幅30、厚み15、長さ260mmのテストピース（未焼成素地）を焼成時にスパン200mmで支持しておき、焼成後のたわみ量とテストピースの厚みを測定した値である。このときのたわみ量は焼成後のテストピースの厚みの二乗に反比例するため、次式で厚みが10mmの時に換算したたわみ量を変形量としている。

焼成変形量＝たわみ量測定値 $\times$ （焼成後のテストピースの厚み） $^2/10^2$

【0031】再加熱時の変形量は、幅25mm、厚み5mm、長さ230mmのテストピース（焼成素地）をスパン200mmの2点で支持し、1000℃まで4時間で昇温し、さらに1200℃まで2時間で昇温し、1200℃で1時間保持した後、室温まで自然冷却したときのテストピースのたわみ量を再加熱時の変形量とする。ただし、テストピースの厚みが5mmになっていない場合については、たわみ量はテストピースの厚みに反比例するので補正した値を再加熱時の変形量とする。その補正方法は、2種類の異なる厚みのテストピースで再加熱時の変形量を実測し、次式でnを算出し、さらにテストピースの厚みが5mmのときの再加熱時の変形量を求め

る。

$$\text{変形量2} = \text{変形量1} \times (\text{厚み1} / \text{厚み2})^n$$

変形量1：厚み1のテストピースでの再加熱時の変形量  
変形量2：厚み2のテストピースでの再加熱時の変形量  
n：補正のための定数

【0032】表面部以外のインキ浸透度としては、素地破断面を代用している。その測定方法については、JISA5207に準じて実施しており、幅30、厚み15、長さ130mmのテストピースを破断させ、破断面を赤インキ溶液（濃度1%のエオシンY溶液）内に1時

間以上浸漬させ、インキを拭き取った後、素地内に浸透した最大浸透寸法を測定した値である。

【0033】表面部インキ浸透度は、幅30、厚み15、長さ130mmのテストピースの裏面、断面など吸水防止処理が施されていない部分に赤インキが浸透しないようにパラフィン、樹脂などで目止めをしたのち、表面部が十分浸漬する量の赤インキ溶液（濃度1%のエオシンY溶液）内に1hr以上浸漬させ、インキを拭き取った後、サンプルを破断し、素地内に浸透した最大浸透寸法を測定した値である。

【0034】図3に実施例と比較例の物性および化学分析値を示す。比較例1は一般的な熔化質素地組成であり、焼結が完全に進行していることから、インキ浸透度は、破断面、表面部とも0.1mmである。ただし、焼成収縮および変形量は最も大きな値を示していることがわかる。比較例2は比較例1から焼結助剤成分が多く含まれる長石、ドロマイトをカオリンへ代替した組成である。アルカリ金属酸化物の量が2重量%以上であり、焼成収縮7.3%、変形量19.2mmと依然として大きく、かつ、表面部の吸水防止処理を施していないため、インキ浸透度が8.0mm以上で表面からの吸水は全く防止できていない状態である。比較例3は、シャモットなどの耐火物原料を併用した場合であり、素地自体のアルカリ金属酸化物量、アルカリ土類金属酸化物量を極力減少させた調合である。この場合、焼成収縮率は3.5%、変形量4.8mmであり、かなり小さくなっている。ただし、表面部の吸水防止処理を施していないため、表面部からのインキ浸透度は8.0mm以上であり、比較例2と同様に吸水は全く防止できていない状態である。

【0035】実施例1は比較例2と同一組成であって、表面部にシラン系浸透性吸水防止剤を刷毛塗り塗布したものである。破断面のインキ浸透度は8.0mm以上と多孔質であるのに対し、表面部からのインキ浸透度は0.5mmとなっている。ただし、素地自体のアルカリ金属酸化物の量が2重量%以上であり、焼成収縮、変形量については、若干高めになっている。実施例2は、比較例3と同一組成であって、シラン系浸透性吸水防止剤を刷毛塗り塗布したものである。表面部のインキ浸透度は0.5mmであり、焼成収縮率は、3.5%、変形量4.8mmであり、非常に小さくなっている。

【0036】実施例3は、比較例3と同一組成であって、表面部にシラン系浸透性吸水防止剤をディッピング塗布したものである。表面部からのインキ浸透度は0.1mmとなっており、ほぼ完全に吸水防止効果を得ることができている。実施例4は、比較例3と同一組成であって、表面部にシラン系浸透性吸水防止剤をエアスプレー塗布したものである。表面部からのインキ浸透度は0.3mmとなっており、ディッピング塗布よりも吸水防止効果が若干劣るものの実用上十分な吸水防止効果を得ることができている。実施例5は、比較例3と同一組成であ

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って、表面部にシリカ系浸透性吸水防止剤をディッピング塗布したものである。この場合においても、インキ浸透度が0.8mmと十分な吸水防止効果を得ることができている。

【0037】

【発明の効果】本発明によれば、水和膨張による経年貫入、凍害、また汚染等の衛生面に問題が生じず、かつ製造時に修正作業等をせずとも製品寸法の精度の良好な陶磁器製水回り製品を提供可能とすることができる。

【図面の簡単な説明】

【図1】 本発明に係る一実施構成例の一般的な腰掛け\*

\* 式便器の断面図である。

(a) 腰掛け式便器の前後方向の断面図

(b) リム断面の拡大図

【図2】 本発明の実施例と比較例の素地調合と化学組成、結晶鉱物。

【図3】 図2記載の実施例と比較例の物性および化学分析値。

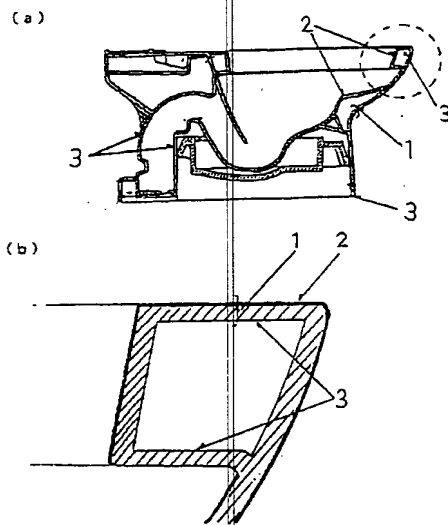
【符号の説明】

1…素地部

2…釉薬層

3…素地表面部(吸水防止処理部位)

【図1】



リム断面(○部)の拡大図

【図3】

素地 No.	比較例 1	比較例 2	比較例 3	実施例 1	実施例 2	実施例 3	実施例 4	実施例 5
破断面インキ浸透度 (mm)	0.1	8.0 以上						
表面部インキ浸透度 (mm)	0.1	8.0 以上	8.0 以上	0.5	0.5	0.1	0.3	0.8
焼成収縮率(%)	10.1	7.3	3.5	7.3	3.5	3.5	3.5	3.5
変形量(mm)	29.9	19.2	4.8	19.2	4.8	4.8	4.8	4.8
再加熱変形量(mm)	18.3	3.6	0	3.6	0	0	0	0
曲げ強度(MPa)	80.2	67.2	54.5	67.2	54.5	54.5	54.5	54.5
熱膨張係数 ( $\times 10^{-6}/^{\circ}\text{C}$ )	70.3	74.8	69.2	74.8	69.2	69.2	69.2	69.2

【図2】

実施例 No.	比較例 1	比較例 2	比較例 3	実施例 1	実施例 2	実施例 3	実施例 4	実施例 5
原料割合 (wt%)	珪石	4.0	3.0	—	3.0	—	—	—
	珪砂	2.0	3.0	2.5	3.0	2.5	2.5	2.5
	珪砂	1.5	3.0	2.0	3.0	2.0	2.0	2.0
	珪目粘土	1.0	1.0	1.5	1.0	1.5	1.5	1.5
	長石	1.0	—	—	—	—	—	—
	ドロマイト	5	—	—	—	—	—	—
	珪砂(珪石)	—	—	1.5	—	1.5	1.5	1.5
	珪石	—	—	1.5	—	1.5	1.5	1.5
化学組成	焼成ベントナイト	—	—	1.0	—	1.0	1.0	1.0
	SiO <sub>2</sub>	65.2	63.9	59.7	63.9	59.7	59.7	59.7
	Al <sub>2</sub> O <sub>3</sub>	29.5	32.0	34.6	32.0	34.6	34.6	34.6
	MgO, CaO	2.2	0.5	0.6	0.5	0.6	0.6	0.6
	Na <sub>2</sub> O	1.6	1.0	0.2	1.1	0.2	0.2	0.2
結晶鉱物	K <sub>2</sub> O	2.0	1.4	0.7	1.7	0.7	0.7	0.7
	ムライト	○	○	○	○	○	○	○
	石英	○	○	○	○	○	○	○
表面部 吸水防止 処理	コランダム	×	○	○	○	○	○	○
	シリカ系浸透性 吸水防止剤	—	—	—	刷毛塗り	刷毛塗り	ディッピング	エア スプレー
	シリカ系浸透性 吸水防止剤	—	—	—	—	—	—	ディッピング
	吸水防止剤	—	—	—	—	—	—	ディッピング

結晶鉱物記号説明 : ○ 素地中に結晶鉱物を含有する。 × 素地中に結晶鉱物を含有しない。